

2015 Monitoring Summary



Borden Creek at Forest Service Road 208 in Lawrence County (34.32944/-87.37750)

BACKGROUND

Borden Creek is among the least-disturbed watersheds in the Dissected Plateau (68e) ecoregion, based on land use, road density, and population density. The Alabama Department of Environmental Management (ADEM) monitors Borden Creek at BRNL-2 as a “best attainable condition” reference watershed for comparison with streams throughout the ecoregion. The objectives of this project were to assess the biological integrity of each monitoring site and to estimate overall water quality within the basin.



Figure 1. Borden Creek at BRNL-2, May 11, 2015.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Borden Creek is a *Fish & Wildlife (F&W)* stream located within the William B. Bankhead National Forest in Lawrence County, Alabama. Based on the 2011 National Land Cover Dataset, landuse within the watershed is predominantly forest (96%). As of April 1, 2016, one NPDES outfall for construction was issued within this watershed.

REACH CHARACTERISTICS

General observations (Table 2) and a habitat assessment (Table 3) were completed during the macroinvertebrate community assessment. In comparison with reference reaches in the same ecoregion, they give an indication of the physical condition of the site and the quality and availability of habitat. Borden Creek at BRNL-2 is a glide-pool stream with substrate composed primarily of sand (Figure 1). Overall habitat quality and availability was rated as *marginal* for supporting diverse aquatic communities.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Black Warrior River
Drainage Area (mi²)		15
Ecoregion^a		68E
Landuse^b		
Open water		
Wetland	Woody	<1%
Forest	Deciduous	68%
	Evergreen	12%
	Mixed	16%
Shrub/scrub		<1%
Grassland/herbaceous		<1%
Pasture/hay		<1%
Cultivated crops		<1%
Development	Open space	1%
	Low intensity	<1%
	Moderate intensity	<1%
	High intensity	
Population/km^{2c}		2
# NPDES Permits^d	TOTAL	1
Construction		1

a. Dissected Plateau

b. 2011 National Land Cover Dataset

c. 2010 US Census

d. #NPDES outfalls downloaded from ADEM's NPDES Management System database, April 1, 2016.

Table 2. Physical characteristics of Borden Creek at BRNL-2, May 11, 2015.

Physical Characteristics		
Width (ft)		40
Canopy Cover		Estimate 50/50
Depth (ft)		
	Run	1.0
	Pool	2.0
% of Reach		
	Run	85
	Pool	15
% Substrate		
	Bedrock	5
	Boulder	5
	Clay	3
	Cobble	3
	Gravel	2
	Hardpan Clay	5
	Sand	55
	Silt	10
	Organic Matter	12

Table 3. Results of the habitat assessment conducted on Borden Creek at BRNL-2, May 11, 2015.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	38	Marginal (31-<55)
Sediment Deposition	38	Marginal (31-<55)
Sinuosity	45	Marginal (31-<55)
Bank and Vegetative Stability	40	Marginal (31-<58)
Riparian Buffer	90	Optimal (>84)
Habitat Assessment Score	192	
% of Maximum Score	54	Marginal (31-<57)

BIOASSESSMENT RESULTS

Benthic macroinvertebrate communities were sampled using ADEM's Intensive Multi-habitat Bioassessment methodology (WMB-I). The WMB-I uses measures of taxonomic richness, community composition, and community tolerance to assess the overall health of the macroinvertebrate community. Each metric is scored on a 100 point scale in comparison to least-impaired reference reaches in the same ecoregion. The final score is the average of all individual metric scores. Metric results indicated the macroinvertebrate community to be in *good* condition (Table 4).

Table 4. Results of the macroinvertebrate community bioassessment conducted in Borden Creek at BRNL-2, May 11, 2015.

Macroinvertebrate Assessment		
	Results	Scores (0-100)
Taxa richness measures		
# EPT taxa	13	39
Taxonomic composition measures		
% Non-insect taxa	11	57
% Dominant taxon	16	88
% EPC	29	55
Functional feeding group measures		
% Predators	20	82
Tolerance measures		
% Taxa as Tolerant	34	43
WMB-I Assessment Score	---	61
WMB-I Assessment Rating		Good (59-79)

SUMMARY

ADEM is currently monitoring Borden Creek at BRNL-2 as a "best attainable" condition reference watershed. Overall habitat quality and availability was rated as *marginal* for its stream type, but bioassessment results indicated the macroinvertebrate community to be in *good* condition. The *F&W* criteria for dissolved oxygen was violated during the month of October, but this coincided with an extremely low flow. However, median total dissolved solids, total specific conductance, hardness, alkalinity, chlorides, and dissolved and total manganese were higher than expected based on data collected at other reference reaches within the ecoregion. Monitoring should continue to ensure that Borden Creek is a "best attainable" condition reference watershed for its ecoregion.

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Table 5. Summary of water quality data collected March-October, 2015. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL) when results were less than this value. Median, average (Avg), and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

Parameter	N	Min	Max	Med	Avg	SD	E	Q
Physical								
Temperature (°C)	9	12.7	23.3	21.0	18.6	3.9		
Turbidity (NTU)	9	2.2	27.8	2.8	6.6	8.3		
Total Dissolved Solids (mg/L)	8	91.0	197.0	150.5 ^M	143.6	36.8		
Total Suspended Solids (mg/L)	8	1.0	35.0	3.0	6.8	11.6		
Specific Conductance (µmhos/cm)	9	131.0	312.0	246.0	235.1	62.3		
Hardness (mg/L)	4	27.3	172.0	118.5 ^G	109.1	60.5		
Alkalinity (mg/L)	8	58.2	166.0	106.0 ^M	106.2	34.7		
Monthly Stream Flow (cfs)	8	0.1	26.0	1.4	4.5	8.8		
Measured Stream Flow (cfs)	7	0.2	26.0	1.7	5.2	9.3		
Chemical								
Dissolved Oxygen (mg/L)	9	4.4 ^C	10.1	7.6	7.7	1.9	1	
pH (SU)	9	7.3	8.0	7.5	7.6	0.2		
Ammonia Nitrogen (mg/L)	8	< 0.007	0.080	0.004	0.014	0.027		
↓ Nitrate+Nitrite Nitrogen (mg/L)	8	< 0.007	0.037	0.006	0.009	0.007		
Total Kjeldahl Nitrogen (mg/L)	8	< 0.056	0.428	0.256	0.218	0.137		
↓ Total Nitrogen (mg/L)	8	< 0.032	0.432	0.275	0.227	0.136		
↓ Dis Reactive Phosphorus (mg/L)	8	< 0.004	0.007	0.004	0.004	0.000		
↓ Total Phosphorus (mg/L)	8	< 0.007	0.019	0.008	0.010	0.004		
CBOD-5 (mg/L)	8	< 2.0	< 2.0	1.0	1.0	0.0		
↓ COD (mg/L)	8	< 1.6	13.1	8.2	7.9	4.5		
↓ TOC (mg/L)	8	1.0	3.8	2.0	2.0	0.9		
↓ Chlorides (mg/L)	8	1.2	2.1	1.6 ^M	1.6	0.3		
Total Metals								
↓ Aluminum (mg/L)	4	< 0.014	0.641	0.047	0.186	0.304		
↓ Iron (mg/L)	4	0.148	0.661	0.216	0.310	0.236		
Manganese (mg/L)	4	0.066	0.122	0.088 ^M	0.091	0.027		
Dissolved Metals								
↓ Aluminum (mg/L)	4	< 0.014	0.031	0.007	0.013	0.012		
↓ Antimony (µg/L)	4	< 0.233	< 0.233	0.116	0.116	0.000		
↓ Arsenic (µg/L)	4	< 0.146	0.510 ^A	0.329	0.310	0.188	2	
↓ Cadmium (µg/L)	4	< 0.118	2.162 ^S	0.059	0.585	1.052	1	
↓ Chromium (µg/L)	4	< 0.131	0.317	0.236	0.213	0.111		
↓ Copper (µg/L)	4	< 0.180	0.507	0.090	0.194	0.208		
↓ Iron (mg/L)	4	0.055	0.138	0.097	0.097	0.036		
Lead (µg/L)	4	< 0.168	< 0.168	0.084	0.084	0.000		
↓ Manganese (mg/L)	4	0.006	0.149	0.094 ^M	0.086	0.067		
↓ Nickel (µg/L)	4	< 0.232	0.577	0.116	0.231	0.230		
↓ Selenium (µg/L)	4	< 0.341	< 0.341	0.170	0.170	0.000		
↓ Silver (µg/L)	4	< 0.208	< 0.208	0.104	0.104	0.000		
Thallium (µg/L)	4	< 0.153	< 0.153	0.076	0.076	0.000		
↓ Zinc (µg/L)	4	< 0.857	1.410	0.428	0.674	0.491		
Biological								
Chlorophyll a (mg/m³)	8	< 1.00	4.27	0.50	0.97	1.33		
E. coli (MPN/DL)	8	23.1	161.6	79.8	83.5	50.9		

A = *F&W* aquatic life use criterion exceeded; G = value higher than median concentration of all verified ecoregional reference reach data collected in ecoregion 68e; J = estimate; M = value >90% of collected samples in ecoregion 68e; N = # of samples.

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. In situ measurements and water samples were collected monthly, March through October of 2015, to help identify any stressors to the biological communities. The *F&W* criteria for dissolved oxygen (5.0 mg/L) was violated during the month of October (4.39 mg/L). However, this value coincided with an extremely low flow (0.1 cfs). Based on data collected at other reference reaches within the Dissected Plateau (68e) ecoregion, median total dissolved solids, total specific conductance, hardness, alkalinity, chlorides, and dissolved and total manganese were higher than expected.